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Maryland Climate Bulletin
January 2024

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DEPARTMENT OF ATMOSPHERIC & OCEANIC SCIENCE
Sumant Nigam, Chair

Maryland State Climatologist Office

Summary

Statewide averages show that January 2024 was warmer and wetter than normal (i.e., 1991-2020 averages). Monthly mean temperatures were in the 28–41°F range; maximum temperatures were between 34 and 50°F, and minimum temperatures were in the 22–33°F. Monthly total precipitation was in the 4.2–7.2 inches range.

Maryland Regional Features (Figures 1-6, C1, and D1)

- Mean temperature was warmer than normal everywhere, especially over western Dorchester County, southern portions of Saint Mary's, and Calvert counties (4°F), and over Howard and Anne Arundel counties and parts of Carroll, Frederick, Montgomery, Baltimore, Prince George's, and Calvert counties (above 3.1°F).

- Maximum temperature was warmer than normal over most of the state, especially over western Dorchester County and southern portions of Saint Mary's and Calvert counties (4.0°F), and over Howard, Anne Arundel counties and portions of Carroll, Montgomery, Baltimore, Prince George's, and Calvert counties (above 2.8°F). Below-normal temperatures appeared over Allegany and Harford counties (around −0.4°F).

- Minimum temperature was also warmer than normal everywhere, particularly over Carroll County (above 4.1°F), Garrett County, and portions of Frederick, Montgomery, Baltimore, Dorchester, Saint Mary's, and Calvert counties (above 3.9°F).

- Precipitation was above normal everywhere in the state, especially over Baltimore County and Baltimore City (above 3.6 in), Prince George's, Anne Arundel, Talbot counties, and portions of Montgomery, Howard, Baltimore, Harford, Kent, Cecil, Queen Ann, Dorchester, Charles, Saint Mary's and Calvert counties (above 3.0 in).

- Drought conditions were absent, and above-normal streamflow was present throughout the state at the end of January 2024. This is the first time the entire state has not been under drought conditions since December 2022. The above-normal precipitation the state has had since December 2023 is behind these improved conditions.

Maryland Climate Divisions (Figures 7-8, B1, and B2)

- All eight climate divisions were warmer and wetter than normal in January, especially the Lower and Upper Southern (CD3, CD4) and Central Eastern Shore (CD2) climate divisions, around 3°F and 3 inches above normal.

- The statewide temperature anomalies were warmer than normal in January, which was preceded by much warmer-than-normal anomalies in December and a colder-than-normal November. The statewide precipitation anomalies have been wetter than normal since December after a drier-than-normal November.

Historical Context (Figure 9, Tables A1 and A2)

- Mean, maximum, and minimum statewide temperatures in January (36.7, 44.7, and 28.7°F) were above the long-term averages and among the 25% of the highest values (1895-2023). Similarly, January's precipitation (5.81 in) was above the long-term average and within 10% of the highest values. January 2024 was the sixth wettest January on record.

- January 2024 was the third wettest January on record in Baltimore City, the fourth wettest January in Anne Arundel and Prince George's counties, and the fifth wettest January in Baltimore, Charles, and Howard counties.

Freezing Days (Figure 10)

- So far this year, statewide minimum temperatures indicated the state has had 19 freezing days (daily minimum temperatures less than or equal to 32°F), from which 5 were in the light freeze range (between 29 and 32°F), 3 in the moderate freeze range (less than 29°F but greater than or equal to 25°F) and 11 in the severe freeze range (less than 25°F). That is fewer than the 1991-2020 climatological counts in freeze days (24 days climatology), moderate freeze days (5.2 days climatology), and severe freeze days (15 days climatology) but more light freeze days than the climatology (3.8 days climatology).

Century-Plus Trends, 1895-2024 (Figures 11, 12)

- Statewide mean temperature and heating degree days in January showed non-significant trends: a warming trend (1.4°F/century) and a decreasing trend (–47.9°FDD/century), respectively. Statewide precipitation had a non-significant drying trend (−0.13 in/century).

- Regionally, January mean temperatures showed significant warming trends only over Baltimore City and the northern parts of Harford and Cecil counties (around 2.0°F/century). Non-significant warming trends are found almost everywhere in the state. Notably, in the Piedmont, between portions of northern Montgomery, Howard, and Anne Arundel counties and the southern portions of Frederick, Carroll, and Baltimore counties, and over the northern parts of Harford and Cecil counties (above 1.8°F/century).

- Regionally, January precipitation had non-significant trends. Drying trends are found over most of the state, particularly in portions of Harford, Cecil, Kent, Allegany, and Charles counties (around −0.4 in/century). Non-significant wetting trends are found over the eastern shore, particularly over southern Somerset and Worcester counties (around 0.4 in/century).

Contents

1. Introduction

The Maryland Climate Bulletin is issued by the Maryland State Climatologist Office (MDSCO), which resides in the Department of Atmospheric and Oceanic Science at the University of Maryland, College Park. It documents the surface climate conditions observed across the state in a calendar month and is issued in the second week of the following month.

Maryland's geography is challenging, with the Allegheny and Blue Ridge mountains to the west, Piedmont Plateau in the center, the Chesapeake Bay, and the Atlantic Coastal Plain to the east. The range of physiographic features and the eastern placement of the state within the expansive North American continent contribute to a comparatively wide range of climatic conditions.

The bulletin seeks to document and characterize monthly surface climate conditions statewide, and climate division and county-wise, placing them in the context of regional and continental climate variability and change to help Marylanders interpret and understand recent climate conditions.

The monthly surface climate conditions for January 2024 are presented via maps of key variables, such as average surface air temperature, maximum surface air temperature, minimum surface air temperature, total precipitation, and their anomalies (i.e., departures from normal); they are complemented by drought conditions for the state, as given by the U.S. Drought Monitor, and streamflow anomalies as given by the U.S. Geological Survey Water Watch (Section 3). Statewide and climate division averages for the month are compared against each other via scatter plots (Section 4). The monthly statewide averages are placed in the context of the historical record via box and whisker plots in Section 5. Freezing days are identified via statewide-averaged minimum air temperatures and displayed in Section 6. Century-plus trends in statewide air temperature, heating degree-days, precipitation, and state maps of air temperature and precipitation are presented in Section 7. Ancillary statewide, climate division, and county-level information is provided via tables and plots in Appendices A-B; climatology and variability maps are in Appendices C-D.

2. Data

Surface air temperatures, total precipitation, and heating degree-days data in this report are from the following sources:

- NOAA Monthly U.S. Climate *Gridded* Dataset at 5-km horizontal resolution (NClimGrid – Vose et al. 2014). It is available in a preliminary status at https://www.ncei.noaa.gov/data/nclimgrid-monthly/access/
  Data was downloaded on 1/11/2024.

- NOAA Monthly U.S. Climate *Divisional* Dataset (NClimDiv – Vose et al. 2014). It is available in a preliminary status (v1.0.0-20240105) at:

https://www.ncei.noaa.gov/pub/data/cirs/climdiv/
Data was downloaded on 1/11/2024.

- NOAA Area averages of daily temperatures and precipitation dataset (NClimGrid−Daily −Durre et al. 2022, 2022a). It is available in a "scaled" status that matches the monthly values (*202402-ste-scaled.csv, v1.0.0) at:
  https://www.ncei.noaa.gov/pub/data/daily-grids/v1-0-0/
  Data was downloaded on 2/16/2024.

Drought conditions are from the U.S. Drought Monitor website:
https://droughtmonitor.unl.edu/Maps/MapArchive.aspx

Streamflow conditions are from the U.S. Geological Survey Water Watch website:
https://waterwatch.usgs.gov/index.php

Some definitions:

About the anomalies: Anomalies for a given month (e.g., January 2024) are the departures of the monthly value from the corresponding month's 30-year average (i.e., from the average of 30 Januaries) during 1991-2020; the 30-year average (or mean) is the climate normal, or just the climatology. When the observed monthly value exceeds its climatological value, it is referred to as above normal (e.g., warmer than normal or wetter than normal) or a positive anomaly. In contrast, when this value is smaller than its climatological value, it is referred to as below normal (e.g., colder than normal or drier than normal) or negative anomaly.

About NOAA's Climate Divisions. The term "climate division" refers to one of the eight divisions in the state that represent climatically homogeneous regions, as determined by NOAA:
https://www.ncei.noaa.gov/access/monitoring/dyk/us-climate-divisions

The eight climate divisions in Maryland are:

- Climate Division 1: Southeastern Shore. It includes the counties of Somerset, Wicomico, and Worcester.
- Climate Division 2: Central Eastern Shore. It includes the counties of Caroline, Dorchester, and Talbot.
- Climate Division 3: Lower Southern. It includes the counties of Calvert, Charles, and St. Mary's.
- Climate Division 4: Upper Southern. It includes the counties of Anne Arundel and Prince George's.
- Climate Division 5: Northeastern Shore. It includes the counties of Kent and Queen Anne's.

- Climate Division 6: North Central. It includes the counties of Baltimore, Carroll, Cecil, Frederick, Harford, Howard, Montgomery, and the city of Baltimore.
- Climate Division 7: Appalachian Mountains. It includes the counties of Allegany and Washington.
- Climate Division 8: Allegheny Plateau. It includes Garrett County.

Note that these Climate Divisions do not correspond with the *Physiographic Provinces* in the state, as the former follow county lines. Climate Division 8 follows the *Appalachian Plateau Province*, Climate Division 7 follows the *Ridge and Valley Province*; however, Climate Division 6 includes the *Blue Ridge and the Piedmont Plateau provinces*, Climate Divisions 3, 4, and a portion of 6 include the *Upper Coastal Plain Province*, and Climate Divisions 1, 2, 5, and a portion of 6 include the *Lower Coastal Plain (or Atlantic Continental Shelf) Province*.

About freezing days. Tracking freezing days is important as the growing season can be approximated as the period between the date of the last killing frost in the spring and the date of the first frost in the fall using the 32°F threshold (USEPA, 2023). A freezing day is defined as a day when the minimum surface air temperature is less than or equal to 32°F. Freezing categories are further defined and approximated depending on how low the minimum temperature reaches (USDA, 2023). A light freeze is defined when the minimum air temperature is between 29° and 32°F; tender plants are killed with little destructive effect on other vegetation. A moderate freeze is defined as when the minimum air temperature is less than 29°F but greater than or equal to 25°F; it has a widely destructive effect on most vegetation, with heavy damage to fruit blossoms and tender and semi-hardy plants. A severe freeze is defined when the minimum temperature is less than 25°F, causing heavy damage to most plants; at these temperatures, the ground freezes solid, with the frozen ground's depth dependent on the freeze's duration and severity, soil moisture, and soil type.

About heating degree-days. Degree-days are the difference between the daily mean temperature (high temperature plus low temperature divided by two) and 65°F. It gives a general idea of how much energy is required to warm buildings; because energy demand is cumulative, degree-day totals for a month are the sum of each day's degree-day total (CPC, 2023).

3. January 2024 Maps

A. Mean Temperatures

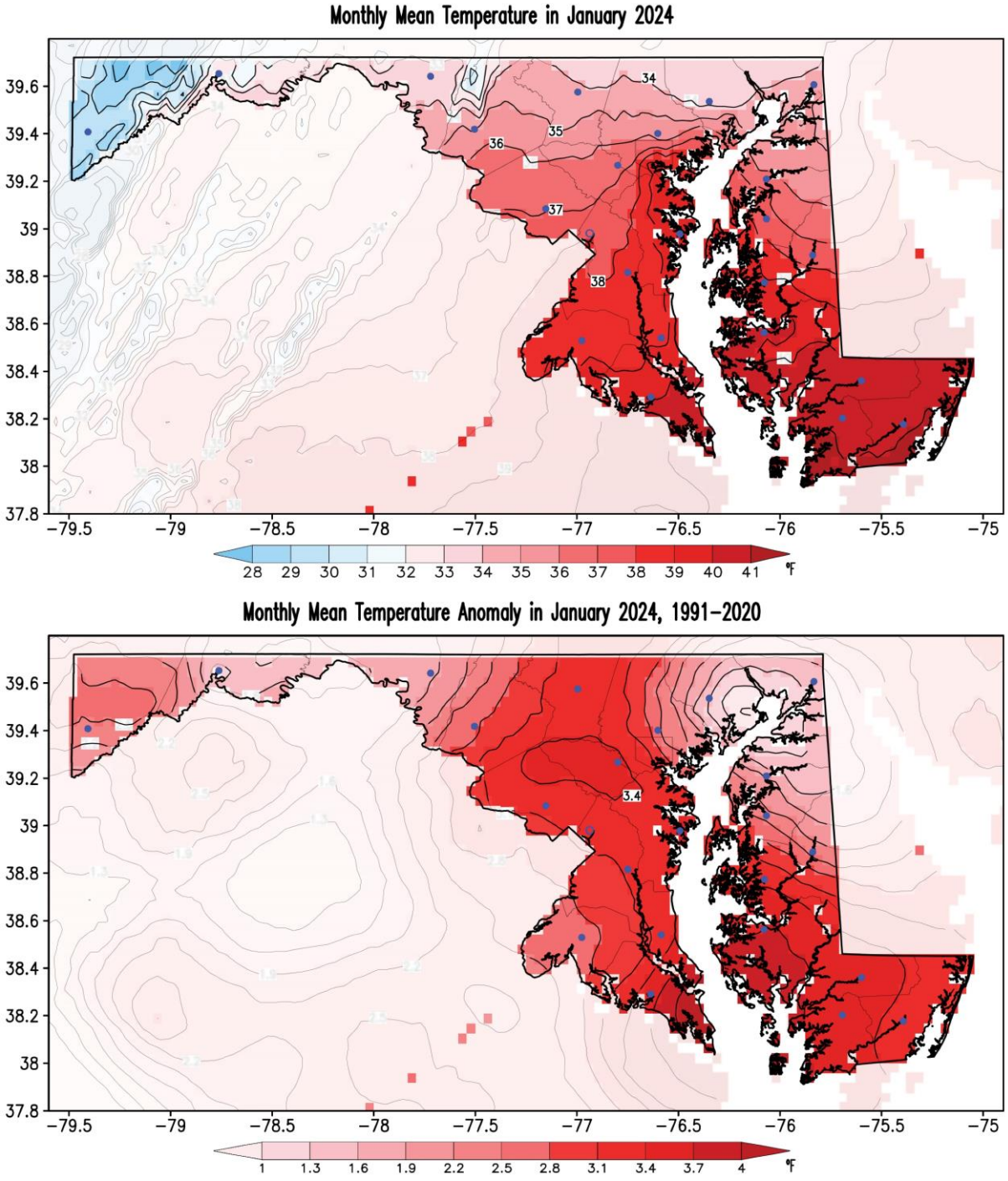

Figure 1. Monthly mean surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for January 2024. Temperatures are in °F following the color bar. Blue/red shading in the temperature map shows temperatures below/above 32°F, while red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

B. Maximum Temperatures

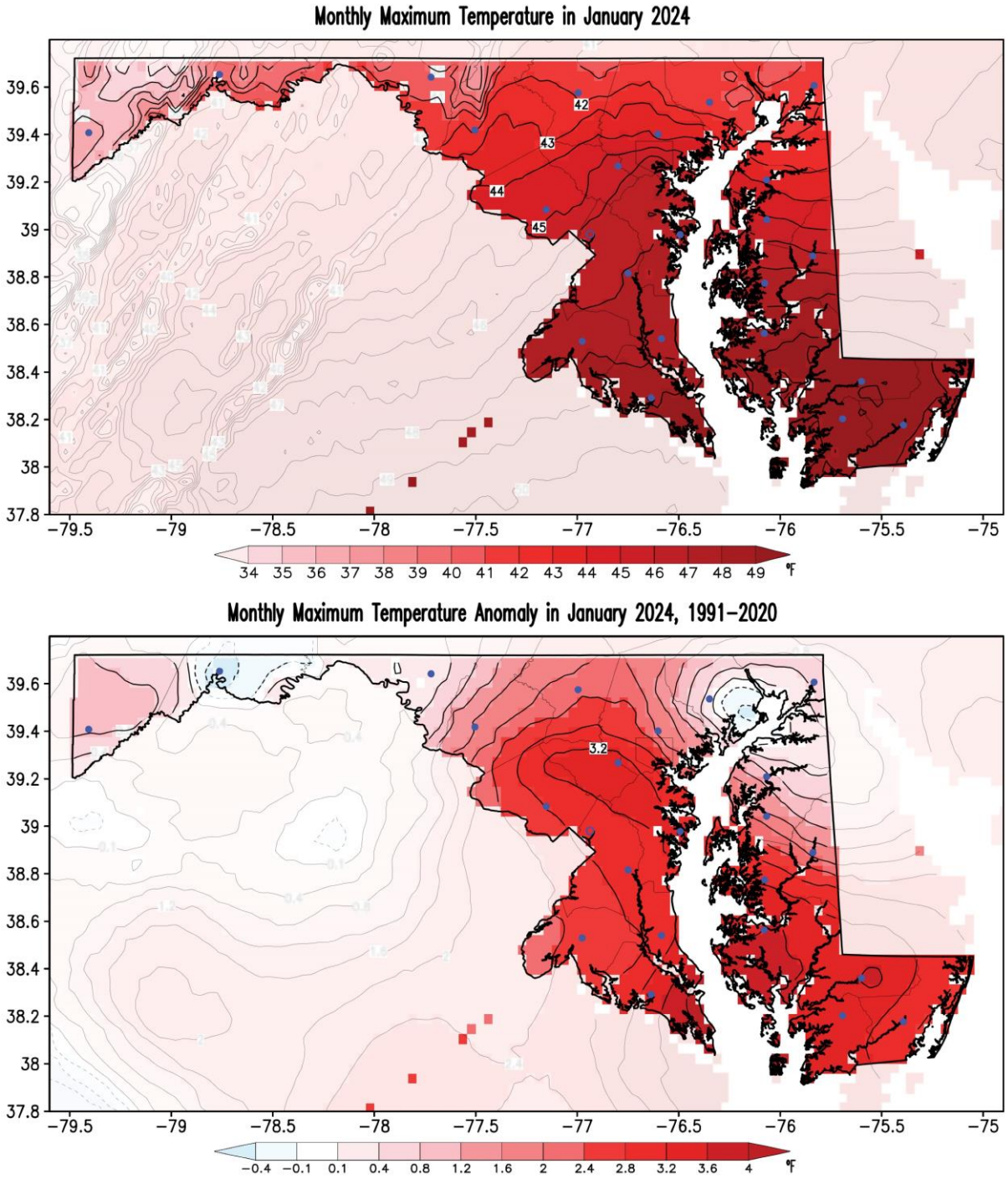

Figure 2. Monthly maximum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for January 2024. Temperatures are in °F following the color bar. Blue/red shading in the anomaly map marks colder/warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

C. Minimum Temperatures

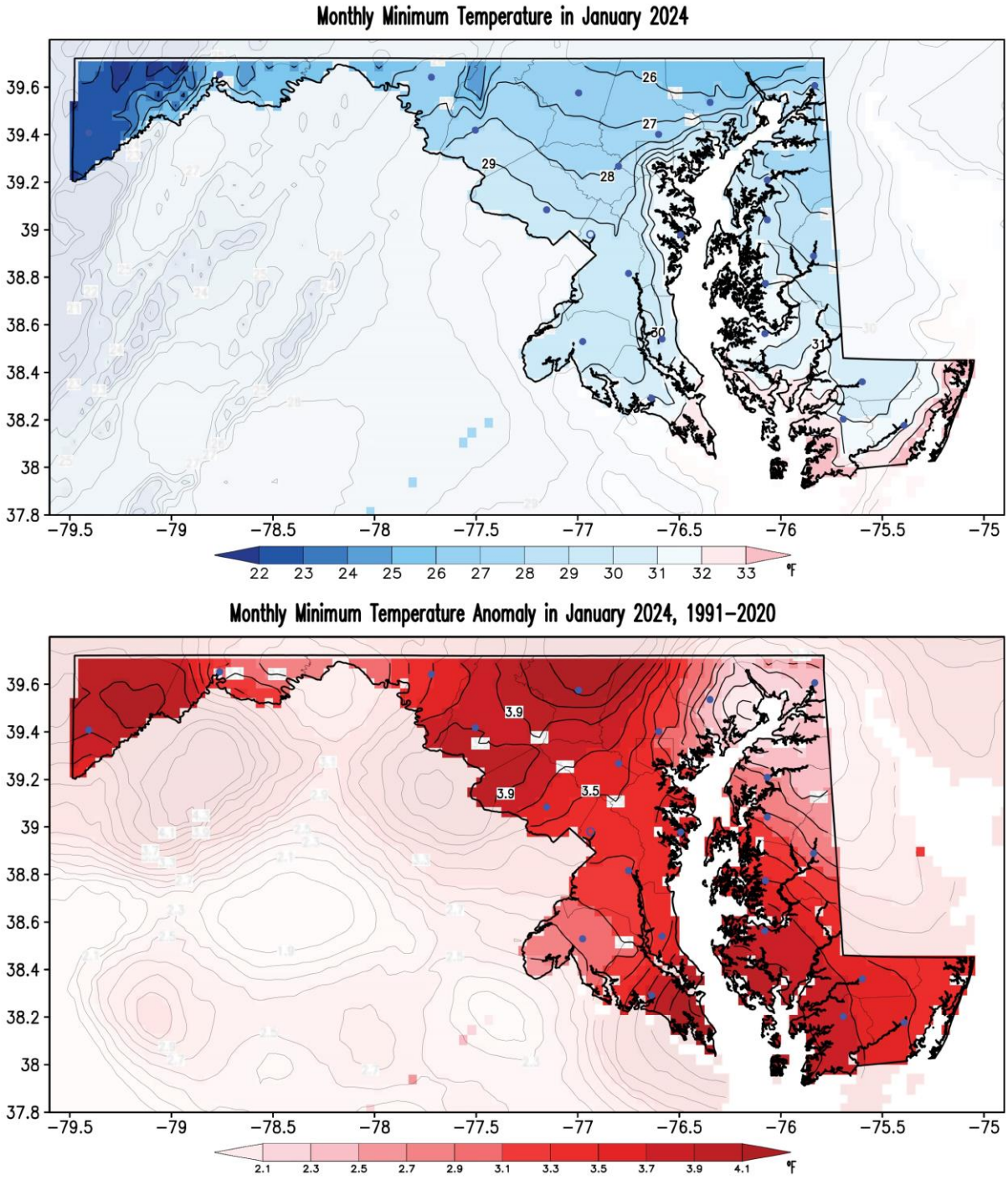

Figure 3. Monthly minimum surface air temperature (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for January 2024. Temperatures are in °F following the color bar. Blue/red shading in the temperature map shows temperatures below/above 32°F, while red shading in the anomaly map marks warmer than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

D. Precipitation

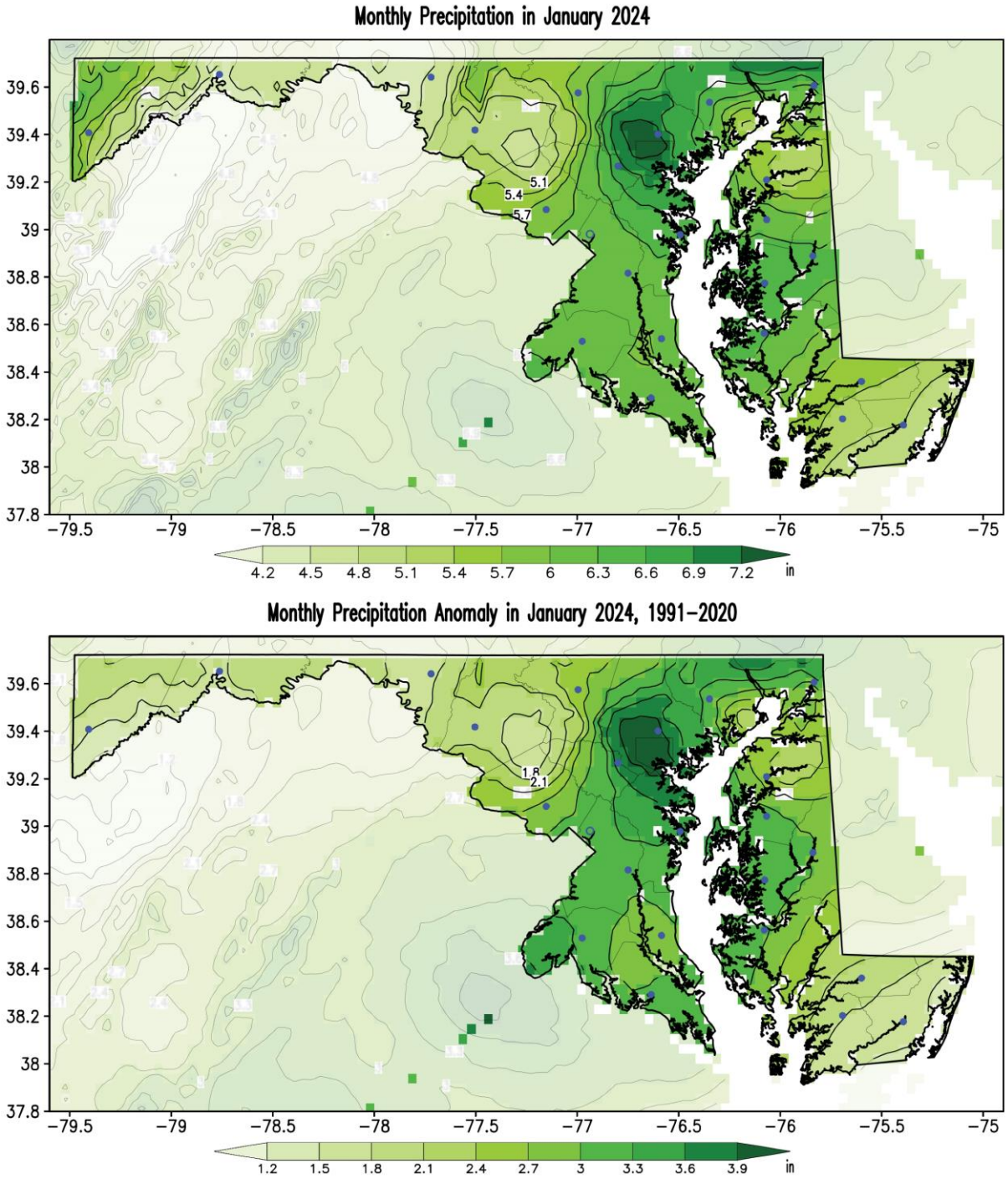

Figure 4. Monthly total precipitation (top panel) and its anomaly with respect to the 1991-2020 climatology (bottom panel) for January 2024. Precipitation is in inches following the color bar. Green shading in the anomaly map marks wetter than normal conditions. Note shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

E. Drought

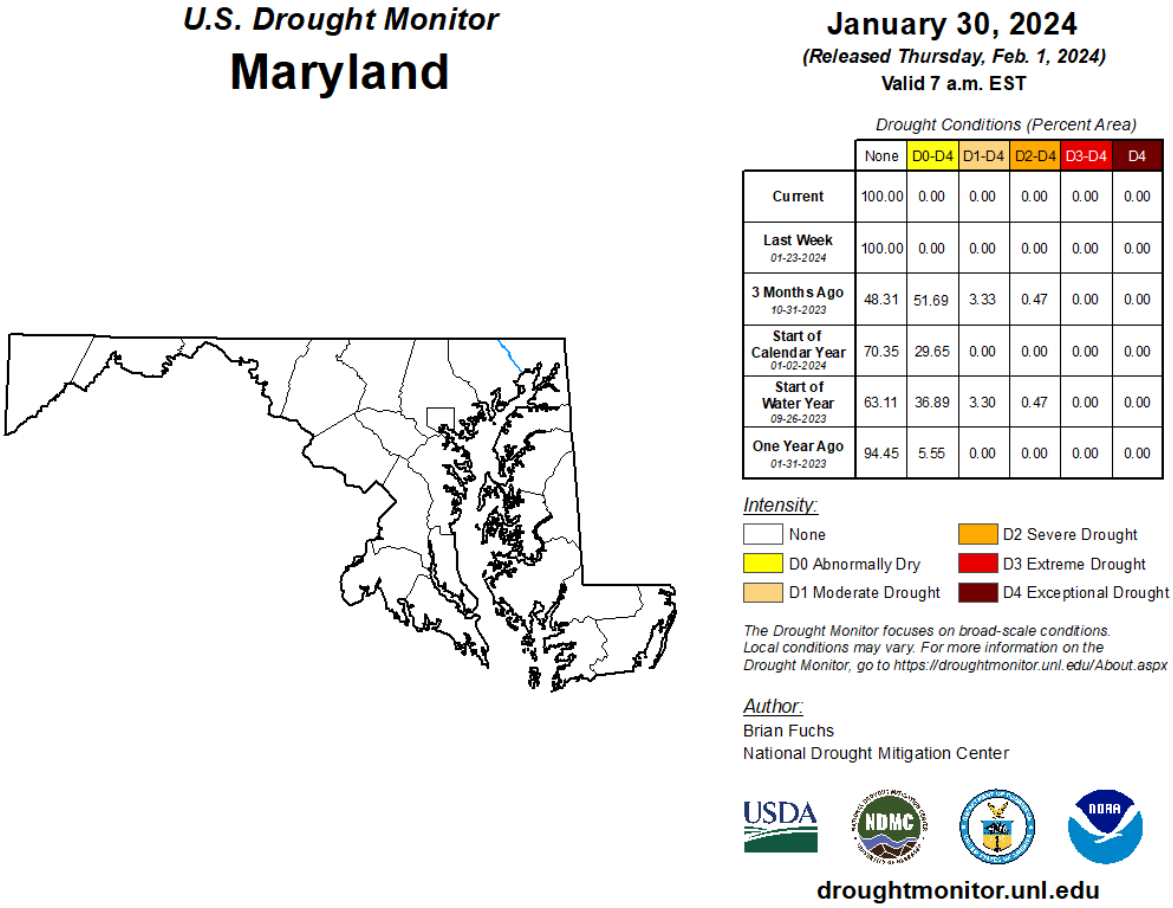

Figure 5. Drought conditions as reported by the U.S. Drought Monitor on January 30, 2024. At this time, the state is drought-free after two months in a row with above-normal precipitation.

F. Streamflow

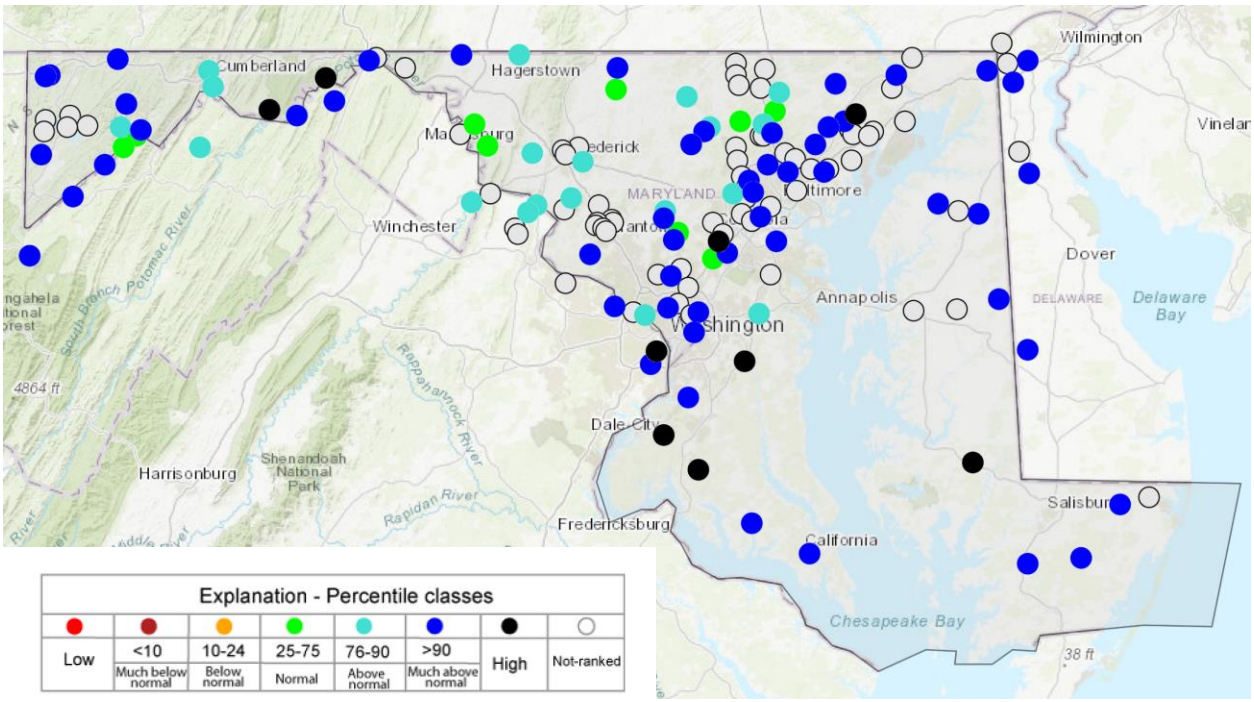

Figure 6. Monthly averaged streamflow class anomalies as reported by the U.S. Geological Survey (USGS) Water Watch for January 2024. Orange to red colors denote below-normal streamflow conditions, and cyan to black denote above-normal streamflow conditions.

4. January 2024 and NDJ 2023/2024 Climate Divisions Averages

A. January 2024 Scatter Plots

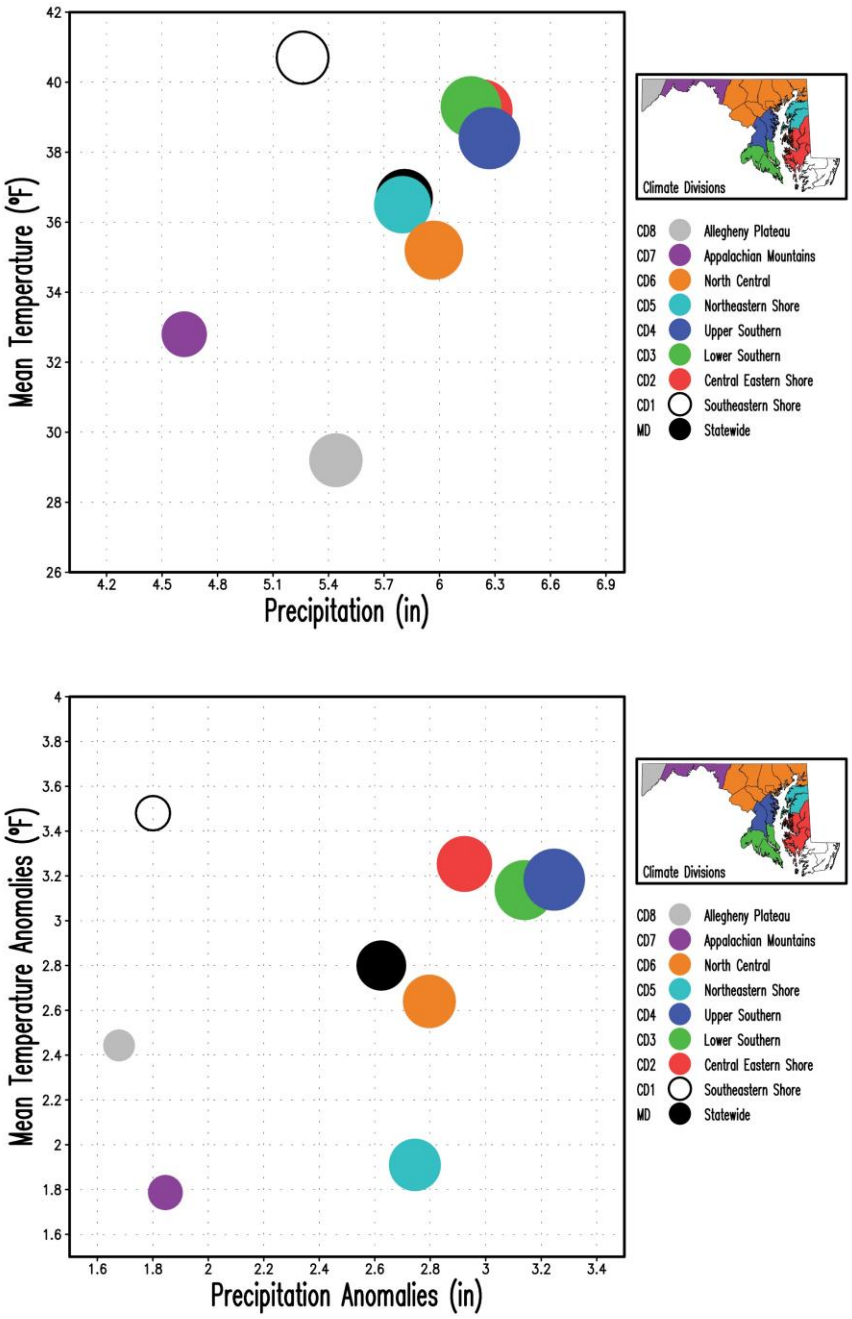

Figure 7. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) monthly mean surface air temperature vs. total precipitation for January 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 1991-2020 climatology. Temperatures are in °F and precipitation is in inches. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation (6.27 inches in CD4, top panel) and by the maximum precipitation anomaly (3.25 inches in CD4, bottom panel) among the nine regions. Note that the color of the filled circles corresponds to the color in the Climate Divisions according to the inset map.

B. November–December 2023 – January 2024 Scatter Plots

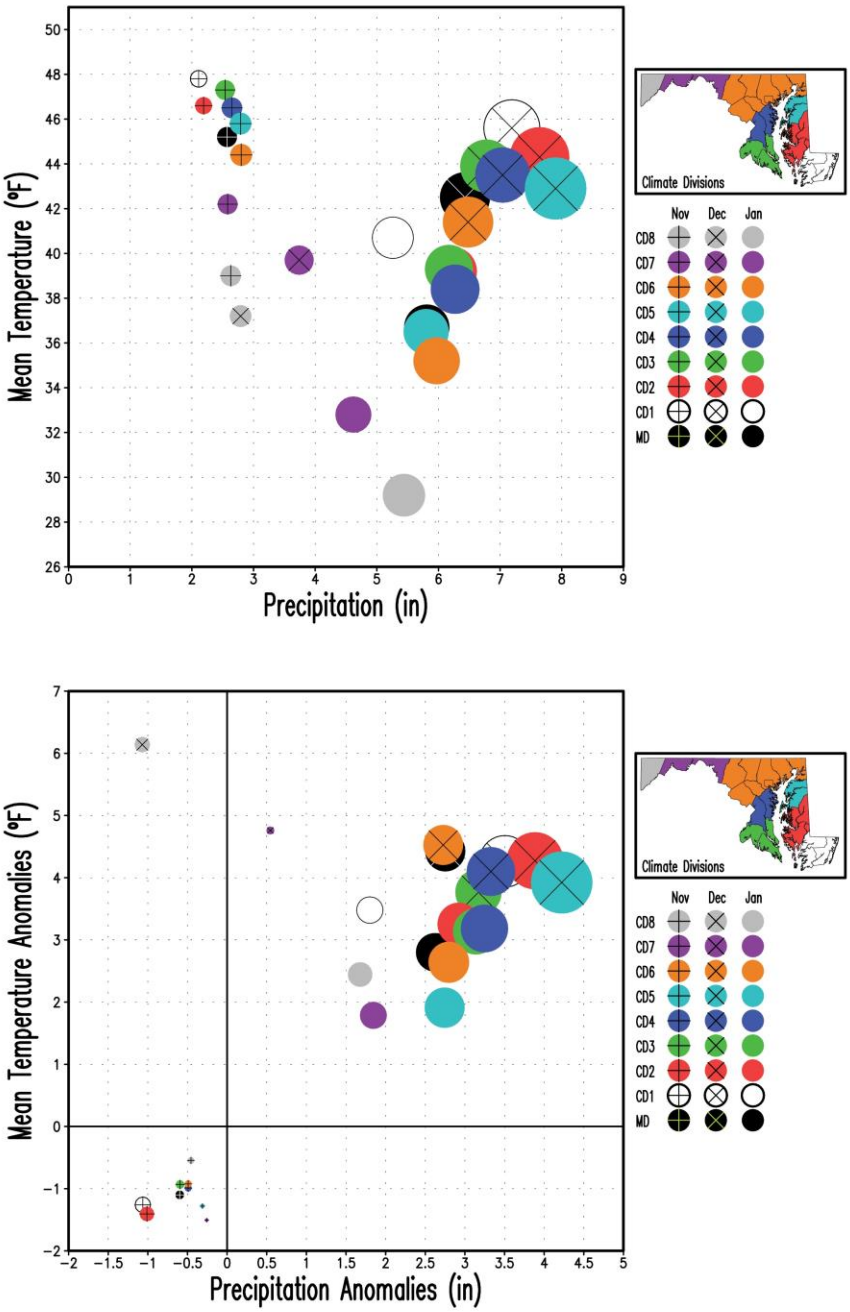

Figure 8. Scatter plots of Maryland (statewide) and Climate Divisions (CD#) monthly mean surface air temperature vs. total precipitation for November, December 2023, and January 2024. The upper panel shows the mean temperature and total precipitation, and the bottom panel displays their anomalies with respect to the 1991-2020 climatology. Temperatures are in °F, and precipitation is in inches. The size of the circles is proportional to the total precipitation scaled down by the maximum precipitation (7.90 inches in CD5 in December, top panel) and by the maximum precipitation anomaly (4.22 inches in CD5 in December, bottom panel) among the nine regions and three months. January is displayed with filled circles only, while December and November are displayed with superposed multiplication and addition signs, respectively.

5. January 2024 Statewide Averages in the Historical Record

A. Box and Whisker Plots

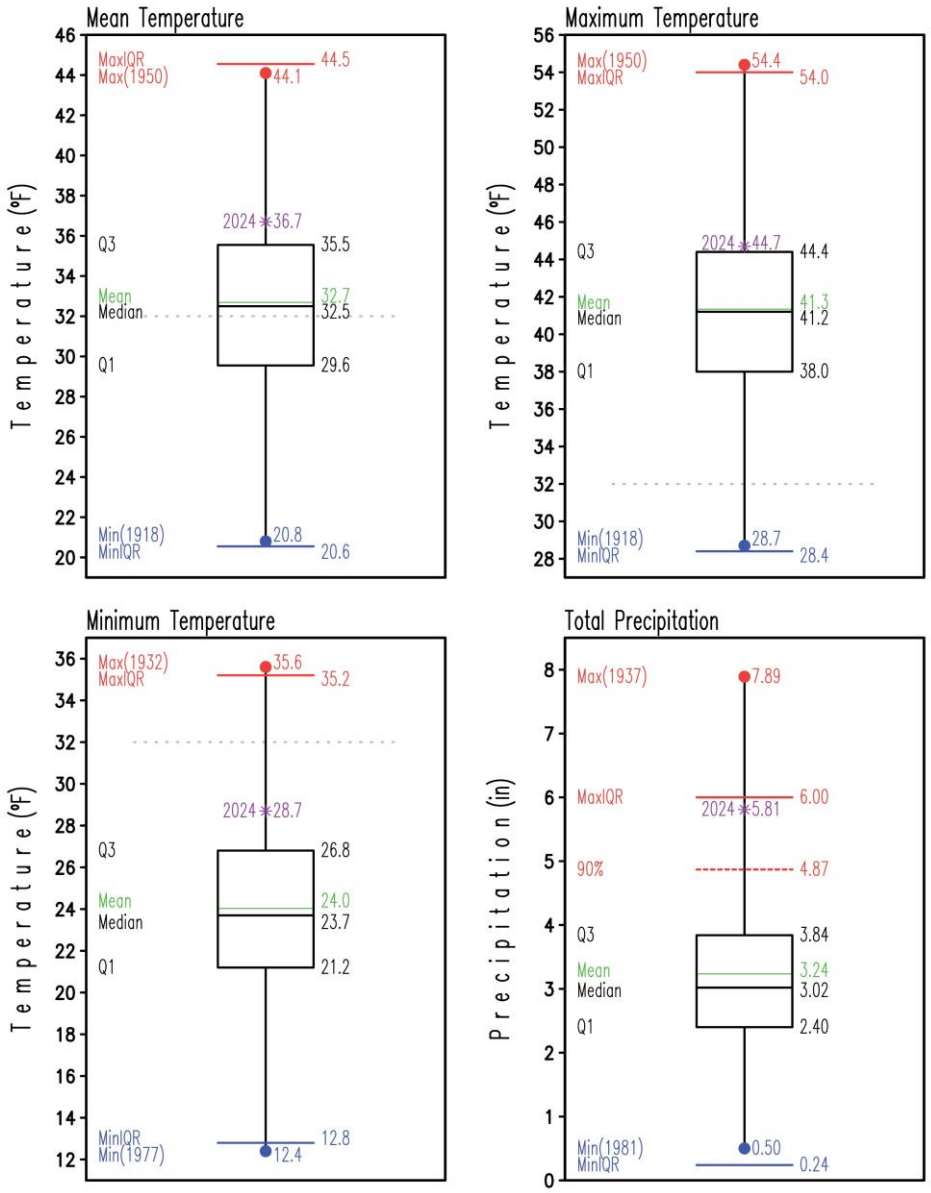

Figure 9. Box and Whisker plots of Maryland (statewide) monthly mean (upper left), maximum (upper right), minimum (lower left) surface air temperatures, and total precipitation (lower right) for January for the period 1895-2023. The label and asterisk in purple represent conditions for January 2024. Statistics for the period 1895-2023 are labeled at the left side of each box and whisker plot and their values at their right. Temperatures are in °F, and precipitation is in inches. The mean is the green line within the box, while the median is the black line within the box. The lower (Q1) and upper (Q3) quartiles, indicating the values of the variable that separate 25% of the smallest and largest values, are the lower and upper horizontal black lines of the box, respectively. The threshold indicating the upper 10% value in precipitation is marked by the dashed red line, while the the 32°F temperature is the dashed gray line. The blue and red dots mark the minimum and maximum values in the period at the end of the whiskers; the year of occurrence is shown in parenthesis. The blue and red horizontal lines represent extreme values defined by Q1-1.5×(Q3-Q1) and Q3+1.5×(Q3-Q1), respectively.

6. January 2024 Statewide Freezing Days

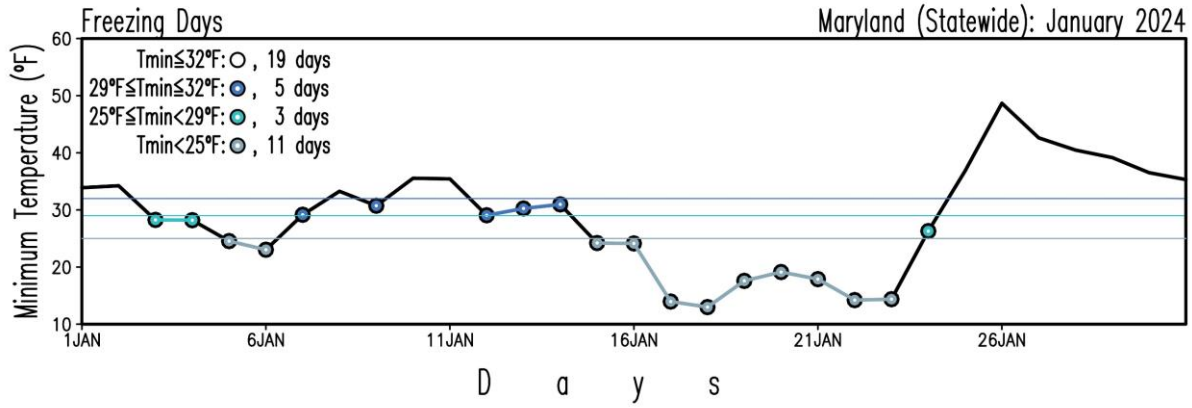

Figure 10. Maryland (statewide) daily minimum temperature and the number of freezing days in January 2024. Temperature is in °F. A freezing day is defined as a day when the minimum surface air temperature is less than or equal to 32°F. The horizontal continuous lines mark the threshold temperatures of 32°, 29° and 25°F. The open circles display temperatures smaller or equal to 32°F; those filled with the darkest blue circles show the days under light freeze conditions; those filled with cyan circles display the days under moderate freeze conditions; and those filled with gray circles show the days under severe freeze conditions. This month had 19 freezing days, of which 5 days were under light freeze conditions, 3 days under moderate freeze conditions, and 11 days under severe freeze conditions; the climatological counts for the period 1991-2020 are 24 freeze days, 3.8 light freeze days, 5.2 moderate freeze days, and 15 severe freeze days.

7. 1895-2024 January Trends

A. Statewide Mean Temperature, Heating Degree-Days, and Precipitation

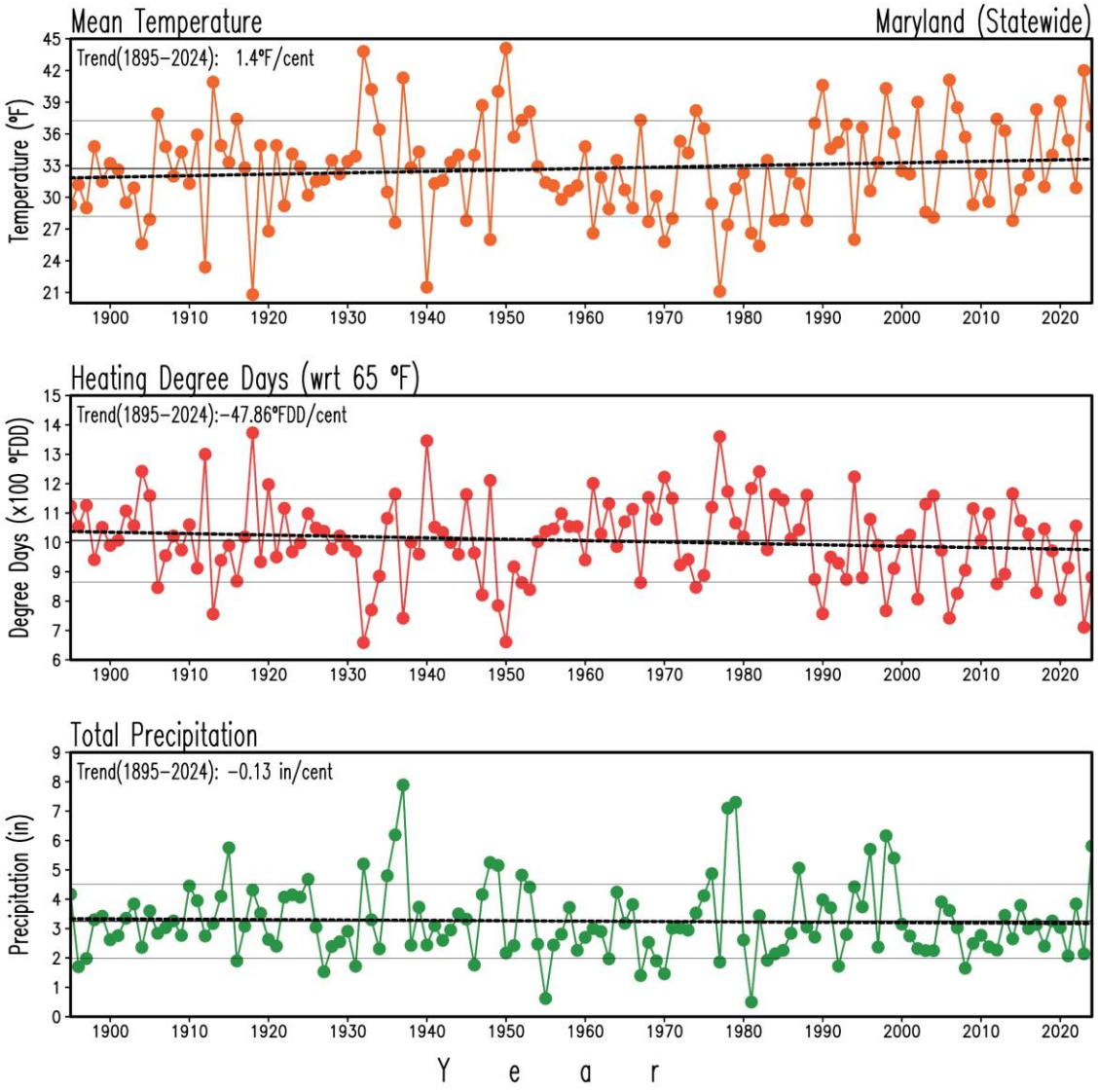

Figure 11. Maryland (statewide) mean surface air temperature, heating degree-days, and precipitation in January for the period 1895-2024. Temperature is in °F, heating degree-days is in °F degree-days (°FDD), and precipitation is in inches. The thin, continuous black lines in each panel display the long-term means (32.7°F, 1006.2°FDD, and 3.26 in, 1895-2024), and the double thin, continuous gray lines indicate the standard deviation (4.5°F, 140.9°FDD, and 1.26 in) above/below the long-term mean. The thick dashed black lines show the long-term linear trend. The warming temperature trend (1.4°F/century), the decreasing heating degree-days trend (−47.9°FDD/century), and the precipitation drying trend (–0.13 in/century) are statistically no significant at the 95% level (*Student's t-test* −Santer et al. 2000).

B. Temperature and Precipitation Maps

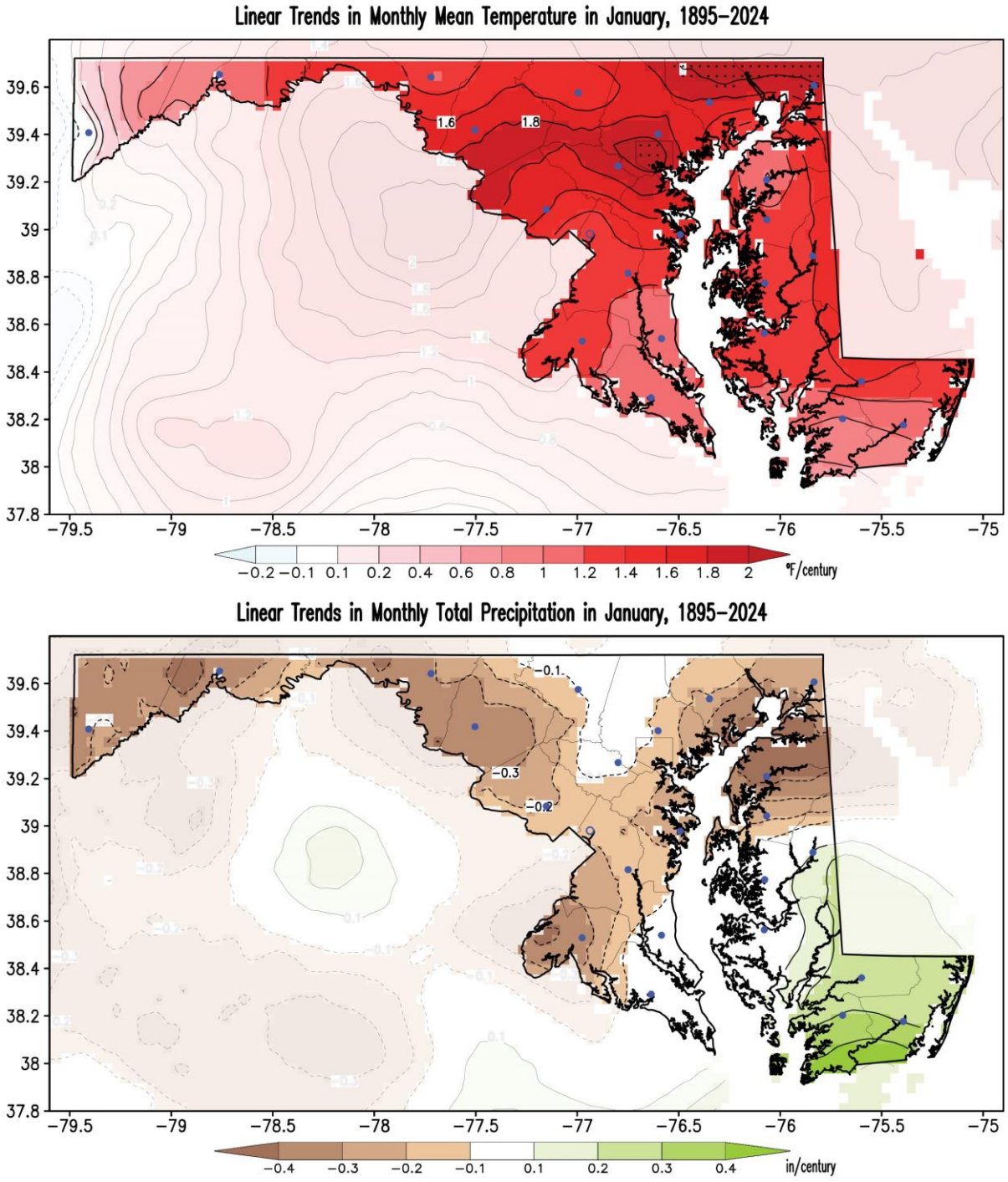

Figure 12. Linear trends in surface air mean temperature and precipitation in January for the period 1895-2024. Temperatures are in °F/century, and precipitation is in inches/century following the color bars. Blue/red shading in the temperature map marks cooling/warming trends. Brown/green shading in the precipitation map shows drying/wetting trends. Stippling in the maps shows regions where trends are statistically significant at the 95% level (*Student's t-test* −Santer et al. 2000). Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

Appendix A. January 2024 Data Tables: Statewide, Climate Divisions, and Counties

A. Mean Temperature and Precipitation

Region	Mean Air Temperature (°F)	Rank (#)
Statewide	36.7	106
Climate Division 1	40.7	111
Climate Division 2	39.2	109
Climate Division 3	39.3	108
Climate Division 4	38.4	108
Climate Division 5	36.5	100
Climate Division 6	35.2	103
Climate Division 7	32.8	99
Climate Division 8	29.2	97
Allegany	32.1	93
Anne Arundel	38.8	110
Baltimore	35.4	104
Baltimore City	37.8	107
Calvert	39.2	109
Caroline	37.8	104
Carroll	34.5	105
Cecil	34.4	96
Charles	38.8	106
Dorchester	40.1	112
Fredrick	34.8	105
Garrett	29.2	97
Harford	34.1	97
Howard	36.4	110
Kent	36.1	98
Montgomery	36.8	108
Prince George's	38.1	107
Queen Anne's	37.0	103
Saint Mary's	40.0	112
Somerset	40.9	111
Talbot	39.2	111
Washington	33.5	100
Wicomico	40.3	111
Worcester	40.8	111

Region	Total Precipitation (in)	Rank (#)
Statewide	5.81	125
Climate Division 1	5.26	120
Climate Division 2	6.23	124
Climate Division 3	6.17	125
Climate Division 4	6.27	127
Climate Division 5	5.80	125
Climate Division 6	5.97	125
Climate Division 7	4.62	122
Climate Division 8	5.44	114
Allegany	4.59	121
Anne Arundel	6.45	127
Baltimore	6.78	126
Baltimore City	7.18	128
Calvert	6.12	125
Caroline	6.26	123
Carroll	5.68	121
Cecil	6.30	125
Charles	6.21	126
Dorchester	6.12	125
Fredrick	5.11	121
Garrett	5.44	114
Harford	6.36	125
Howard	6.08	126
Kent	5.62	125
Montgomery	5.58	124
Prince George's	6.16	127
Queen Anne's	5.95	125
Saint Mary's	6.14	125
Somerset	5.27	121
Talbot	6.42	125
Washington	4.65	121
Wicomico	5.52	122
Worcester	5.07	116

Table A1. Monthly mean surface air temperature (left) and total precipitation (right) at Maryland (statewide), climate division, and county levels for January 2024. Temperatures are in °F, and precipitation is in inches. The rank is the order that the variable for January 2024 occupies among the 130 Januaries after the 130 values have been arranged from the lowest to the highest in the *standard competition ranking method*. The closer to 130 the rank is, the larger (i.e., the warmer/wetter) the value of the surface variable is in the record; similarly, the closer to 1 the rank is, the smaller (i.e., the colder/drier) the value of the surface variable is in the record.

B. Maximum and Minimum Temperatures

Region	Maximum Air Temperature (°F)	Rank (#)
Statewide	44.7	102
Climate Division 1	49.4	109
Climate Division 2	47.8	108
Climate Division 3	48.2	106
Climate Division 4	46.8	104
Climate Division 5	44.2	89
Climate Division 6	42.8	96
Climate Division 7	39.8	77
Climate Division 8	35.6	75
Allegany	38.9	72
Anne Arundel	46.9	107
Baltimore	43.3	96
Baltimore City	45.6	104
Calvert	47.9	106
Caroline	46.4	102
Carroll	42.2	98
Cecil	41.5	84
Charles	47.8	104
Dorchester	48.8	112
Fredrick	42.1	96
Garrett	35.6	75
Harford	41.5	83
Howard	44.9	106
Kent	43.5	87
Montgomery	44.6	104
Prince George's	46.7	103
Queen Anne's	44.8	92
Saint Mary's	48.9	108
Somerset	49.4	110
Talbot	47.4	109
Washington	40.6	85
Wicomico	49.6	112
Worcester	49.3	107

Region	Minimum Air Temperature (°F)	Rank (#)
Statewide	28.7	110
Climate Division 1	32.0	111
Climate Division 2	30.6	110
Climate Division 3	30.4	110
Climate Division 4	30.0	109
Climate Division 5	28.8	108
Climate Division 6	27.6	109
Climate Division 7	25.8	110
Climate Division 8	22.7	110
Allegany	25.3	110
Anne Arundel	30.6	110
Baltimore	27.5	110
Baltimore City	29.9	109
Calvert	30.6	110
Caroline	29.1	110
Carroll	26.7	112
Cecil	27.2	102
Charles	29.9	108
Dorchester	31.3	111
Fredrick	27.4	111
Garrett	22.7	110
Harford	26.7	104
Howard	28.0	109
Kent	28.8	107
Montgomery	29.0	110
Prince George's	29.4	109
Queen Anne's	29.1	109
Saint Mary's	31.1	111
Somerset	32.4	111
Talbot	31.0	110
Washington	26.3	110
Wicomico	31.0	110
Worcester	32.3	111

Table A2. Monthly maximum (left) and minimum (right) surface air temperatures at Maryland (statewide), climate division, and county levels for January 2024. Temperatures are in °F. The rank is the order that the variable for January 2024 occupies among the 130 Januaries after the 130 values have been arranged from the lowest to the highest using the *standard competition ranking method*. The closer to 130 the rank is, the larger (i.e., the warmer) the value of the surface variable is in the record; similarly, the closer to 1 the rank is, the smaller (i.e., the colder) the value of the surface variable is in the record.

Appendix B. January 2024 Bar Graphs: Statewide, Climate Divisions, and Counties

A. Temperatures and Precipitation

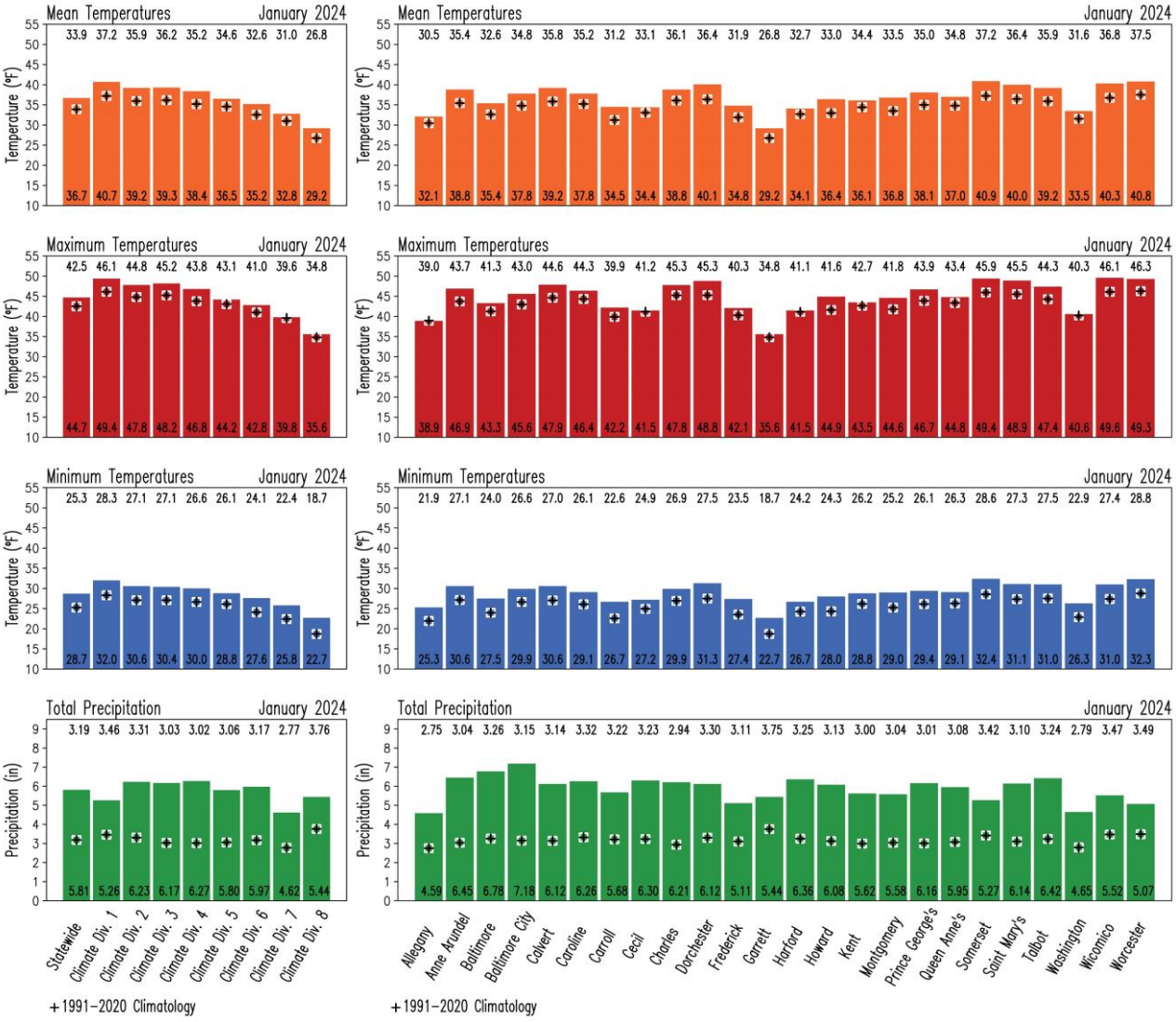

Figure B1. Monthly surface variables in Maryland for January 2024. Color bars represent the variables as follows: mean surface air temperature (orange), maximum surface air temperature (red), minimum surface air temperature (blue) and total precipitation (green) at statewide and climate division (left column), and at county (right column) levels. Temperatures are in °F and precipitation is in inches. The numbers at the base of the bars indicate the magnitude of the variable for January 2024. For comparison, the corresponding 1991-2020 climatological values for January are displayed as black addition signs, and their magnitude are shown at the top of the panels.

B. Temperatures and Precipitation Anomalies

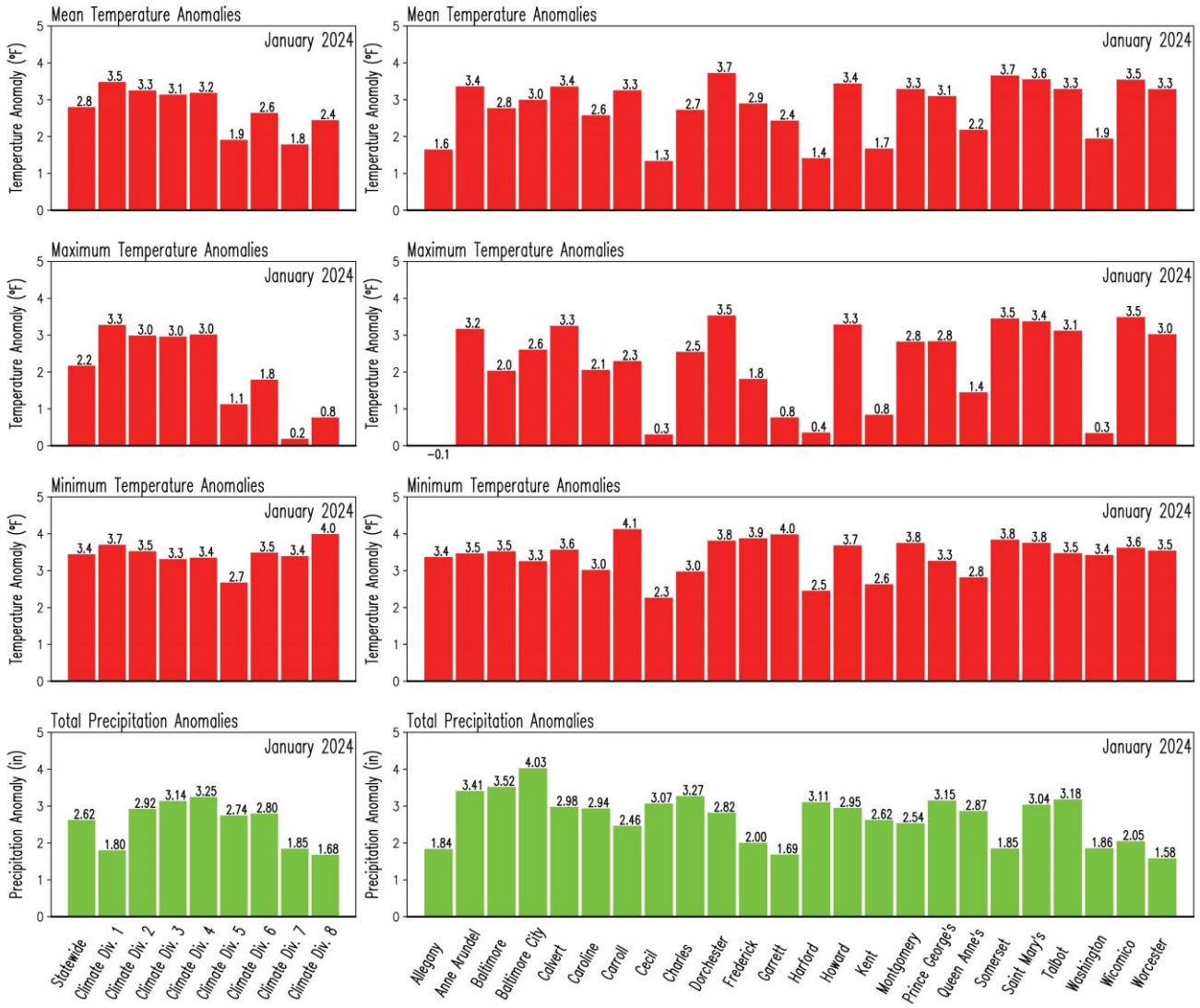

Figure B2. Anomalies of the monthly surface variables in Maryland for January 2024. Anomalies are with respect to the 1991-2020 climatology. Red color represents positive (warmer than normal) anomalies for mean surface air temperature (upper row), maximum surface air temperature (second row from top), and minimum surface air temperature (third row from top), while green color indicates positive (wetter than normal) anomalies in total precipitation (bottom row) at statewide and climate division (left column), and at county (right column) levels. Temperatures are in °F, and precipitation is in inches. The numbers outside of the bars indicate the magnitude of the anomaly for January 2024.

Appendix C. January 1991-2020 Climatology Maps and January 2024 Precipitation as Percentage of Climatology

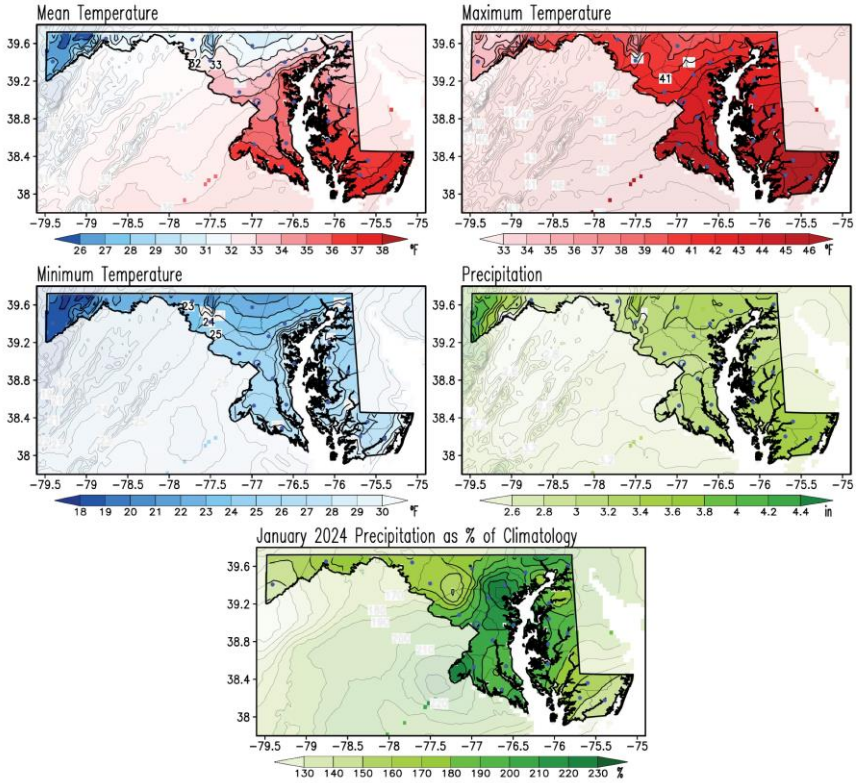

Figure C1. January climatology of the monthly mean, maximum and minimum surface air temperatures, and total precipitation for the period 1991-2020 (upper and middle rows), and precipitation in January 2024 as a percentage of climatology (bottom row). Temperatures are in °F, and precipitation is in inches according to the color bars. This is the current climate normal against which the January 2024 conditions are compared to obtain the January 2024 anomalies (from Figure 1 to 4). The precipitation as a percentage is obtained by dividing the total precipitation (from Figure 4) by the climatology (from the middle right panel) and multiplying that ratio by 100 so units are in percent of climatology (%); green shading in this map shows wetter than normal conditions. Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

Weather and climate are closely related, but they are not the same. Weather represents the state of the atmosphere (temperature, precipitation, etc.) at any given time. On the other hand, climate refers to the time average of the weather elements when the average is over long periods. If the average period is long enough, we can start to characterize the climate of a particular region.

It is customary to follow the World Meteorological Organization (WMO) recommendation and use 30 years for the average. The 30-year averaged weather data is traditionally known as Climate Normal (Kunkel and Court 1990), which is updated every ten years (WMO 2017). Establishing a climate normal or climatology is important as it allows one to compare a specific day, month, season, or even another normal period with the current normal. Such comparisons characterize anomalous weather and climate conditions, climate variability and change, and help define extreme weather and climate events (Arguez et al. 2012).

Appendix D. January Standard Deviation and January 2024 Standardized Anomalies Maps

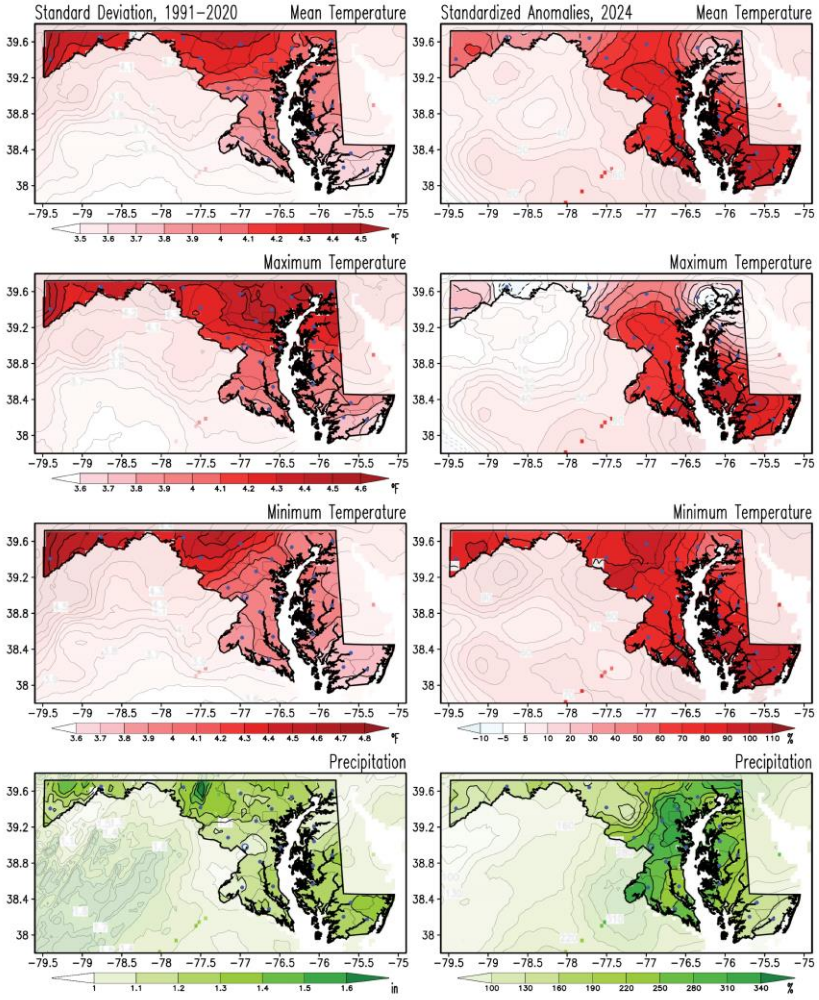

Figure D1. Standard deviation for January and standardized anomalies of temperatures and precipitation for January 2024. Standard deviations for monthly mean, maximum, and minimum surface air temperatures and total precipitation were obtained for the 1991-2020 period (left column). Anomalies for January 2024 (right column) are obtained as a percentage of the standard deviations. The standard deviations in temperatures are in °F, and those in precipitation are in inches according to the color bars. Blue/red shading in the anomaly temperature maps marks colder/warmer than normal conditions; green shading in the anomaly precipitation map marks wetter than normal conditions. The standardized anomalies are obtained by dividing the raw anomalies (from Figures 1 to 4) by the standard deviation (from left column panels) and multiplying that ratio by 100; hence, units are in percent (%). Note that shading outside the state has been washed out to facilitate focusing on Maryland. Filled blue circles mark the county seats.

The monthly standard deviation measures a climate variable's year-to-year, or interannual, variability. Anomalies are sometimes compared against that variability to identify extremes in the climate record. When the anomalies are divided by the standard deviation, they are named *standardized anomalies*.

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